IMPROVING THE PALATABILITY OF ORAL NUTRITIONAL SUPPLEMENTS FOR ELDERLY PEOPLE AIMING TO INCREASE INTAKE

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Abstract

Oral nutritional supplements are beverages designed for people known to have, or to be at risk of, malnutrition. They can lead to increase in body weight and nutritional status, however the products are frequently wasted due to unacceptable taste or sweetness. The hypothesis of this study was that reduction in sweetness would alter older people’s perception and preference of the products. Replacement of sucrose with palatinose\textsuperscript{TM} and reduction of serving temperature (from 21°C to 6°C and -13 °C) both significantly reduced perceived sweetness by trained sensory panel and by older consumers (n= 25 to 29, age range 65-84). Clusters of consumers preferred the less sweet variants, although there was no significant difference in mean preference.

Introduction

There is a high prevalence of malnutrition in elderly people; in the UK it can be as high as 60% of hospitalised patients (1). Oral nutritional supplements (ONS) are used to treat malnutrition in elderly people. They can have beneficial effects on body composition (2), however, the benefits can only be delivered if the older patients consume the products. The wastage of ONS is high and can be due to dislike of taste and sweetness (3).

This study reports on sweetness modification of ONS, aiming to improve acceptability of the products and improve consumption compliance. Palatinose\textsuperscript{TM} (\(\alpha\)-D-glucopyranosyl-1,6-fructose) has the same calorific value as sucrose, however the rate of absorption is slower than sucrose (4) and it is 50\% less sweet than sugar. Low dextrose equivalent (DE) maltodextrin, like glucose syrup, is manufactured by the partial hydrolysis of maize starch; however it has a higher proportion of polysaccharide and a lower level of glucose and, hence a lower relative sweetness. Anecdotal evidence suggests that the temperature of serving affects the acceptability of the products (5). Lower temperature affects taste and flavour, either by suppressing flavour release or due to a numbing effect on the palate.

Experimental

Manufacture of UHT ONS modifications. ONS samples were manufactured on a pilot scale ultra heat treatment (UHT) plant, at 142°C for 4 seconds. The control formulation consisted, per 100g, of glucose syrup (18.7g), sodium caseinate (3.8 g),
sucrose (2.2g), oil blend (4.9g), milk protein concentrate (2g), soy protein isolate (1.4 g) and a commercial blend of emulsifier, vanilla flavour, vitamins and minerals. In a palatinose™ modification, all sucrose was replaced with palatinose™. In a low DE maltodextrin modification, the sucrose was replaced with palatinose™ and 25% of the glucose syrup (22 DE) was replaced with the maltodextrin (5 DE). The total solids content of all products, as measured by refractometer, was 32 %. pH ranged from 6.6 to 6.8. Density ranged from 1.05 and 1.09 g/ml. The control and palatinose™ formulations had viscosities (Brookfield synchro-lectric viscometer) of 0.11 Pascal seconds (Pa-s), whereas the low DE maltodextrin formulation was more viscous at 0.31 Pa-s.

**Manufacture of ice cream.** The formulation for ice cream, per 100 g consisted of commercial ONS (Ensure Plus, Vanilla) (94.7g), sucrose (4.5g) and stabiliser (0.8g; mixture of guar, locust bean and carrageen gum). The sucrose was in order to lower the freezing point and produce a sufficiently soft ice cream. Ice cream was manufactured using a batch pasteuriser (80°C) and horizontal freezer. Air incorporation calculated as the percentage change in density, or overrun, was 70 %.

**Sensory panel.** Twelve screened and trained assessors (age 21-27) developed a sensory vocabulary to characterise Vanilla ONS using two commercial vanilla ONS products. A consensus vocabulary was reached on 20 attributes. Quantitative sensory assessment took place in individual sensory booths. Each sample (20 g) was given a 3-digit code, assessed twice with a randomised presentation order. Data was acquired using TASTE software (Reading Scientific Services Ltd., Reading, UK). Intensity was scored using 100-point unstructured line scales. To compare sweetness modifications, products were served at room temperature. To compare temperature, the commercial vanilla products was served at room temperature (21°C), chilled (6°C) and as ice cream (-13 °C).

**Consumer panel.** An older healthy adult cohort (n=25-29, age 65-84) preference tested products using a 9 point hedonic scale (extremely dislike, 1, to extremely like, 9). Sweetness intensities were scored using a 100-point unstructured line scale. Sample were 3-digit coded, presentation order was randomised.

**Statistical analysis.** Parametric testing of quantitative data and non-parametric testing of preference data were carried out using SenpaQ (Qi Statistics) and XLSTAT (version 2008.3.01).

**Results and Discussion**

Replacement of sucrose with palatinose™ resulted in a profile of reduced sweetness (p< 0.001) and dairy flavour (p= 0.05). Changing 25% glucose syrup for low DE maltodextrin further reduced sweetness, but significantly increased viscosity (p= 0.007) (Figure 1).

Older consumers perceived the reduction in sweetness (p< 0.0001). Preference was split between consumers who preferred less sweet variants, and those who preferred the sweeter control (Figure 2), there was no difference in mean preference. The viscosity of the maltodextrin modification was not liked.

Regarding temperature, the analytical panel found ice cream to be significantly lower in odour than the room temperature product (p< 0.05 for 3 odours) and sweet taste to be significantly lower in the chilled drink compared to the room temperature drink (p= 0.06). Older consumers found significant difference in sweetness between serving temperatures (p= 0.001). Clusters of consumers preferred chilled and ice cream products over the standard room temperature product (Figure 3).
Conclusions

Sweetness of ONS was successfully reduced by replacing sucrose with palatinose™, and by reducing serving temperature. Reducing sweetness did increase acceptability of products for some older consumers, but not for all. Further work is needed to establish the effect of repeat consumption on preference, and to establish the effect of reduced sweetness on preference of other flavour variants.
Figure 3. Preference map of ONS products at different temperatures (Diamond = consumer liking; Text box = sample position; Line and attribute = sensory driver).

Acknowledgments

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References

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